



ACCREDITATION UNIT

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SAFETY POLICY FOR CHEMICAL AND BIOLOGICAL SECTOR

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### ***Purpose***

The policy objectives are as follows:

- To describe proper practices, procedures, equipment and facilities to the persons working in each laboratory.
- To protect them from potential health hazards presented by chemicals used in the laboratory workplace.
- To keep exposures below specified limits.

### ***Scope***

This policy is intended to assist chemical and biological laboratories with guidelines to control safety risks as required by Accreditation Unit

### ***Authorship***

This publication has been written by the Technical Committee, and approved by the Accreditation Director.

### ***Official language***

The text may be translated into other languages as required. The English language version remains the definitive version.

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### ***Further information***

This policy is mandatory for laboratories, and shall be implemented within four months from its issuance date.

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This document is also available at our web site where you can check updates directly.

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## 1 Introduction

The Accreditation Unit has set this safety policy to promote safe practices in laboratories.

The policy includes information concerning safe practices, the use of personal protective equipment, emergency procedures, use and storage of chemicals, and the proper methods of waste disposal. This information is intended to help those in the laboratory to minimize the hazards to themselves and their colleagues. Because laboratories involve numerous chemicals, procedures, and operations, they require extensive safety precautions. Laboratory safety involves chemical safety, fire safety, electrical safety, and other safety issues.

## 2 Responsibilities

It is the responsibility of administration, research and supervisory personnel to know and to follow the provisions of this Policy.

## 3 Definitions

**Acute Exposure:** An intense exposure over a relatively short period of time.

**Biohazard agent:** Infectious agents that present a risk or potential risk to the health of humans or other animals, either directly through infection or indirectly through damage to the environment.

**Carcinogen:** A substance that may cause cancer in animals or humans.

**Chemical gases:** Chemical substances that exist in the gaseous state at room temperature

**Explosive:** A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure or high temperature.

**Flammable Gas:** A gas that, at an ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or, a gas that, at an ambient temperature and pressure forms a range of flammable mixtures with air more than 12 percent by volume, regardless of the lower limit.

**Flammable Liquid:**

**-Class I Flammable Liquids: a liquid that have a flash point below 37.8°C and a vapor pressure below 275kPa absolute at 37.8°C**

**-Class 1A Flammable Liquids: includes liquids that have flash point below 22.8°C and a boiling point below 37.8°C**

**- Class 1B Flammable Liquids: includes liquids that have flash point below 22.8°C and a boiling point at or above 37.8°C**

**-Class 1C Flammable Liquids: includes liquids that have flash point at or above 22.8°C but below 37.8°C**

**Hazardous Chemicals:** Any chemical for which there is significant evidence that acute or chronic health effects may occur exposed personnel. The term "health hazard" includes chemicals that are carcinogens, toxins, irritants, corrosives, sensitizers or other agents that can damage the lungs, skin, eyes or mucous membranes.

**Ignitable:** A solid, liquid or compressed gas waste that has a flash point of less than 140°F.

**Inhalation:** The breathing in of an airborne substance that may be in the form of gas, fumes mists, vapors, dust, or aerosols.

**Irritant:** A substance that produces an irritation effect when it contacts skin, eyes, nose, or respiratory system.

**Laboratory:** A facility where relatively small quantities of hazardous materials are used on a non production basis.

**Laboratory Hood:** A device constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory.

**Personal Protective Equipment:** Any devices or clothing worn by the worker to protect him against hazards in the environment. Examples are respirators, gloves, and chemical splash goggles.

**Respirator:** A device which is designed to protect the wearer from inhaling harmful contaminants.

**Toxicity:** The potential of a substance to exert a harmful effect on human or animals and a description of the effect and the conditions or concentration under which the effect takes place.

## 4 Policy

Everyone in the lab is responsible for his/ her own safety and for the safety of others. Before starting any work in the lab; familiarize yourself with the procedures, equipment, and chemicals that are to be used .

All staff should have a proper safety training .This policy is recommended for working safely in a lab.

### A- Personal Practices, Hygiene and Sanitation

1. Never wear shorts, sandals, or open-toed shoes in the lab.
2. Do not allow children or pets in laboratories.
3. Never pipette anything by mouth.
4. Be aware of dangling jewelry, loose clothing, or long hair that might get caught in equipment.
5. Keep your head scarf under your lab coat.
6. Designate non-lab areas for eating and drinking.

7. Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present. Avoid storage, handling or consumption of food or beverages in all laboratories .Store food and drinks in refrigerators that are designated for that use only. Do not use laboratory equipment to serve or store food or drinks.
8. Do not wear lab coats, gloves, or other personal protective clothing out of the lab and into non-lab area. This clothing may have become contaminated and you could spread the contamination.
9. Never work alone in a lab. If you must work alone, make someone aware of your location and ask them to call or check on you periodically.
10. Wash areas of exposed skin well frequently throughout the day and before leaving the laboratory.
11. Contact lenses should not be worn in a lab because chemicals or particulates can get caught behind them and cause severe damage to the eye. Use medical glasses instead of lenses.
12. Treat all chemicals as if they were hazardous.
12. Minimize your exposure to any chemical and avoid repeated exposure to any chemical. Avoid direct contact with any hazardous chemical.
13. Follow any special precautions for the chemicals in use
14. Never underestimate the potential hazard of any chemical or combination of chemicals.
15. Assume that a mixture or reaction product is more hazardous than any component or reactant.
16. Do not pour hazardous chemicals down the sink.
17. Remove and use only the amount of chemicals needed for the immediate job at hand.
18. Properly seal, label, and store chemicals in appropriate containers.
19. Keep the containers clearly marked and in a well-ventilated area.
20. Work under the fume hood for hazards reagents.
21. Do not mix waste of reagents.
22. Label waste bottles.
23. When reagent received to your body wash it with plenty of water.
24. Do not try to distinguish between substances by tasting it.
25. To make dilution for acid, you have to add water then the reagent not inverse.
26. Be aware that open packages of tobacco products can absorb chemical vapors.
27. Work from clean to dirty not from dirty to clean.
28. Don't touch your face or adjust PPE with contaminated gloves.
29. Never wash or reuse disposable gloves.
30. Remove gloves if they become torn; perform hand hygiene before donning new gloves.

## **B- Housekeeping**

1. Clean your work area throughout the day and before you leaves at the end of the day.
2. If necessary, clean equipment after use to avoid the possibility of contaminating the next person who needs to use it.
3. Keep all aisles and walkways in the lab clear to provide a safe walking surface and an unobstructed exit way

## **C- Laboratory Facility**

The laboratory facility should have:

- (a) An appropriate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air.
- (b) Adequate, well-ventilated stockrooms / storerooms
- (c) Laboratory hoods and sinks
- (d) Other safety equipment including eyewash fountains and showers
- (e) Arrangements for waste disposal.
- (f) Adequate Maintenance, Chemical hygiene-related equipment (hoods, incinerator, etc.) should undergo continuous appraisal and be modified if inadequate.
- (g) Non slip surfaces
- (h) Passageways. Stairways and hallways should not be used as storage areas .Access to exit emergency equipment, and utility controls should never be blocked.
- (i) A list should be on the outside of the door showing what potential hazards are in the lab (high voltage, chemicals, etc...)
- (j) Keep a fire extinguisher nearby lab, emergency showers, and eye wash stations, first acid.

## **D- Glassware**

1. Inspect all glassware before use. Repair or discard any broken, cracked, or chipped glassware.
- 2-Transport all glass chemical containers in rubber or polyethylene bottle carriers.
- 3-Apply good practice when inserting glass tubes or rods into stoppers.
- 4 - Never use glassware under pressure or vacuum unless it is designed for the job and suitably shielded.

## **E- Ultraviolet Lamps**

1. Wear ultraviolet absorbing protective safety glasses while working with ultraviolet light.
2. Protect your skin from potential burns due to ultraviolet light.
3. Shield any experiment in which ultraviolet light is used in order to prevent the escape of the direct beam or scattered radiation.

## **F- Chemical Handling and Storage**

1. Information on proper handling, storage and disposal of chemicals should be made available to all laboratory employees prior to the use of the chemical.
2. Always purchase the minimum amount necessary to maintain operations.
3. Chemical containers with missing or defaced labels should not be accepted.
4. Chemicals utilized in the laboratory must be appropriate for the laboratory's ventilation system.
5. Chemicals should not be stored on the floor or high shelves. Large bottles should be stored no more than two feet from floor level. Storage of chemicals at the lab bench or other work areas shall be kept to a minimum.
6. Chemicals should be stored so that they are separated from other chemicals with which they might react. Use the flammable, acid or base storage cabinets as appropriate.
7. Be careful to store temperature sensitive chemicals in appropriate refrigerators or freezers. Standard refrigerators are not appropriate for storing volatile and/or flammable chemicals. Use explosion-proof refrigerators for storing flammable chemicals.
8. Any chemical mixture shall be assumed to be as toxic as its most toxic component.
9. Substances of unknown toxicity shall be assumed to be toxic.
10. Toxic substances should be segregated in a well-identified area with local exhaust ventilation. Chemicals which are highly toxic or other chemicals whose containers have been opened should be in unbreakable secondary containers.
11. Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity.
12. Stockrooms/ storeroom should not be used as preparation or repackaging areas, should be opened during normal working hours, and should be controlled by one person.
13. Exposure to heat or direct sunlight should be avoided.

### **14. Flammable chemicals must be stored in a flammable liquid storage cabinets**

**-Cabinets must be made of metal having a double wall with a 3point door latch and a liquid tight door sill raised at least 50 millimeters above the floor.**

**- Cabinets must be conspicuously labeled, indicating that the cabinet contains flammables and that open flames and sources of ignition must be kept away.**

**- The maximum quantity of 500 liters of flammable and combustible liquids may be stored in an approved cabinet.**

**- containers shall be kept closed at all times other than when transferring to another container**

**- flammables must be stored at least one meter away from incompatible materials**

**- always purchase and store the smallest quantity of flammable liquid necessary for the work be done**

**-do not place cabinets near exits**

### **G- Transferring Chemicals**

1. Carry glass containers in specially designed bottle carriers or a leak resistant, unbreakable secondary container.
2. Do not transport unprotected chemicals between the work area and other areas. Use a tray, rack, cart or rubber carrier.
3. When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.
4. Always use a secondary container when transporting hazardous or highly odorous chemicals on an elevator.
5. When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.
6. Special systems are needed for handling materials under pressure:
  - a- Cylinders must be secured in an upright position at all times.
  - b- Do not allow cylinders to fall or lean against one another.
  - c- Use an appropriate cart to move cylinders.
  - d- Always wear goggles or safety glasses with side shields when handling compressed gases.
  - e- Always use appropriate gauges, fittings and materials compatible with the particular gas being handled.

### **H- Personal Protective Equipment, Safety Equipment & Hygiene**

- First -- assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of PPE, In general the PPE should be selected based on the hazard you are facing & on which part of your body this hazard will impact.
1. To prevent contamination from getting into eyes, goggles are the best choice. Safety glasses do not provide a seal around the eye

2. Face shields are also an excellent choice for protecting the entire face from splash contamination.
3. You should wear lab coats, lab aprons or chemical resistant protective suits and chemically resistant gloves to prevent contamination of our skin. Avoid wearing clothes that leave large areas of skin bare, such as shorts and sandals, when you plan to work in the lab. You will need to make sure that the chemicals you will be handling will not degrade the gloves you plan to wear.
4. To prevent inhalation of chemical gases, vapors, dust or aerosols you should work in a fume hood. Wearing a respirator is the very last option to consider when providing inhalation protection. Before anyone can be approved to wear a respirator, they must satisfy these two requirements:
  - (1) An annual medical evaluation to determine whether or not a person is physically capable of wearing a respirator.
  - (2) A fit-test evaluation to ensure that the respirator seals properly around the face and does not allow unfiltered air to leak in.

You must make sure that the cartridges in your respirator will absorb the chemicals you are planning on working with.

5. Engineering controls are the best way to reduce airborne exposure to nanoparticles. Use standard ventilated enclosures such as fume hoods and Type II biological safety cabinets with HEPA filters. Research suggests that HEPA filters should effectively remove nanoparticles from contaminated airstreams. Local exhaust systems may be used if a process cannot be enclosed. A laminar flow hood that directs the flow of HEPA-filtered air to the users face should NEVER be used.
6. The sequence for removing PPE is as the following:
  - Gloves
  - Face shield or goggles
  - lab coat
  - Mask or respirator.
7. Ensure that PPE is disposed or reusable PPE is cleaned, laundered, repaired and stored after use.
8. Used respirators when using organic solvent, such chloroform and dichloromethane

### **I- Emergency Showers & Eye Wash Stations**

If you contaminate yourself over a large part of your body or over a part of your body that you cannot rinse off in the sink, immediately go to the emergency shower, strip off any contaminated

clothing, and stay under the water for at least 15 minutes. If something splashes into your eye, immediately flush with water for as long as possible. The general rule is to flush with water for 15 minutes.

### **J- Personnel Exposures and Emergency Procedure:**

If a person is contaminated with a chemical, seconds can make a huge difference in the severity of injury:

1. Make sure you know exactly where the nearest emergency showers and eye wash stations are located.
2. Strip contaminated clothing off of the victim and rinse the contaminated area for at least 15 minutes.
3. In case of a medical emergency, seek medical care from the Emergency Department. Call for an ambulance to transport the victim if necessary.

At the same time the following procedures should be applied to respond to the spills:

- Evacuate anyone in immediate danger.
  - Stop the spread of the spill as soon as possible. Use appropriate absorbent material to contain the spill.
  - Consult the Material Safety Data Sheet (MSDS) for proper decontamination procedures.
4. Be prepared to tell emergency responders what chemical(s) are involved in the spill.
  5. There should be an alarm system to alert people in all parts of the facility.
  6. Accidents should be carefully analyzed and results distributed to all who might benefit.

#### 7. First Aid

8. *Wounds* Cleanse area with water as appropriate.

9. *Small cuts and scratches* place the sterile pad over wound and apply gentle pressure evenly with the opposite hand. If direct gentle pressure does not control bleeding, raise the area above the level of the heart. Apply dressing plaster as appropriate. If there is significant bleeding place the sterile pad over wound and apply gentle pressure.

10. *Thermal Burns* First degree burns are characterized by redness or discoloration of the skin, mild swelling and pain. These can be treated by rinsing or immersing in water for at least 10 minutes and applying a skin cream as appropriate, and seeking further medical treatment as needed. Second and third degree burns are characterized by red or scalded skin with blisters (second degree), white or charred skin (third degree). Immediate first aid is to clean the area if possible and keep it dry and call for medical help immediately.

11. *Chemical Burns* If hazardous chemicals should come into contact with skin or eyes, follow the first aid procedures, remove garments as required and rinse the affected area with large quantities of water for at least 15 minutes (sink, shower, or hose). Do not apply burn

ointments/spray to affected areas. Call for medical help without delay. Eyes: Rinse area of eyes, eyelids, and face thoroughly with lukewarm water for at least 15 minutes at the eye wash station and call for medical help without delay.

### **K - Waste Disposal**

1. All waste chemicals must be identified by full chemical name, including the proportions of a mixture. Do not use symbols or abbreviations.
2. All containers must be labeled prominently, because the safe transportation of chemicals is possible only when everyone who handles the containers knows the identity of the contents.
3. Unknown waste cannot be accepted for disposal.
4. All containers of hazardous waste must have an "Orange Hazardous Waste Label" attached to them to identify the type of waste.
5. Waste chemicals should be stored in break-resistant containers.
6. Wastes must be packaged and containerized in a manner which will allow them to be transported without the danger of spillage, explosion, or hazardous vapors escaping.
7. Do not discharge any of the following contaminants to the sewer: concentrated acids or bases; highly toxic, malodorous, or lachrymatory substances; substances that might interfere with the biological activity of wastewater treatment plants; and substances that may create fire or explosion hazards, cause structural damage, or obstruct flow.

### **L- Electrical SAFETY**

1. Examine all electrical cords periodically for signs of wear and damage. If damaged electrical cords are discovered, unplug the equipment and send it off for repair.
2. All equipment must be properly grounded.
3. If sparks are noticed while plugging or unplugging equipment or if the cord feels hot, do not use the equipment until it can be serviced by an electrician.
4. Do not use portable space heaters in laboratories or other areas where chemicals are present.
5. Extension cord use should be kept to a minimum.
6. Do not overload circuits.
7. Do not attempt to repair or clean the insides of electrical equipment.
8. Never use electrical equipment in wet locations.
9. Never operate electrical equipment while touching a metal object.

### **M-FIRE SAFETY**

1. Keep flammable and combustible chemical storage to a minimum.
2. Do not accumulate combustible trash in laboratories, especially near exits and corridors.

3. Never pour volatile liquids down the sink.
4. Keep containers of flammable liquids capped when not in use.
5. Install explosion-proof electrical equipment in areas where flammable liquids are used and may generate vapor concentrations at ignitable levels.
6. Report damaged or defective electrical equipment to Facilities Management.
8. Avoid using open flames whenever possible.
9. Understand the different types of fires and extinguishers and know what types of extinguishers are available in your area.

### **N- Material Safety Data Sheets (MSDS)**

A Material Safety Data Sheet is a detailed report about a chemical or chemical formulation. The report includes a description of the hazards associated with the chemical and how to safely handle it. You must keep your MSDS in a location that is convenient for everyone in your lab.

Information that must be included on an MSDS includes:

- Chemical Product & Company Information
- Information on Ingredients
- Hazards Identification
- First Aid Measures
- Fire Fighting Measures
- Accidental Release Measures
- Handling & Storage
- Exposure Controls & Personal Protection Physical & Chemical Properties
- Stability & Reactivity
- Toxicological Information
- Ecological Information
- Disposal Considerations
- Transport Information
- Regulatory Information

### **O- Environmental Monitoring**

Environmental conditions, which affect safety, should be monitored and recorded.

### **P- BIOLOGICAL SAFETY**

In addition to the above safety precautions which should be followed the following principles should also be adopted to reach the utmost biosafety in Biological Labs

## 1- Biosafety Principle

The primary principle of biological safety (i.e., biosafety) is containment. The term containment refers to a series of safe methods for managing infectious agents in the laboratory. The purpose of containment is to reduce or eliminate human and environmental exposure to potentially harmful agents.

## 2- Primary and Secondary Containment

There are two levels of biological containment: primary and secondary:

Primary containment: protects people and the immediate laboratory environment from exposure to infectious agents. Good microbial techniques and safety equipment provide sufficient primary containment. Examples of primary barriers include safety equipment such as biological safety cabinets, enclosed containers, and safety centrifuge cups. Occasionally, when it is impractical to work in biological safety cabinets, personal protective equipment; such as lab coats and gloves may act as the primary barrier between personnel and infectious materials.

Secondary containment protects the environment external to the laboratory from exposure to infectious materials. Good facility design and operational practices provide secondary containment. Examples of secondary barriers include work areas that are separate from public areas, decontamination facilities, and hand washing facilities, special ventilation systems, and airlocks.

### ***IMPORTANT:***

Employees working with infectious agents or potentially infectious materials must be aware of the hazards associated with their work. These workers must be trained and proficient in bio safety procedures and techniques.

## 3- General Biosafety Guidelines:

Bio-hazardous materials require special safety precautions and procedures.

### *a- Personal Hygiene Guidelines:*

Wash your hands thoroughly, as indicated below:

- After working with any biohazard
- After removing gloves, laboratory coat, and other contaminated protective clothing
- Before eating, drinking, smoking, or applying cosmetics
- Before leaving the laboratory area
- Do not touch your face when handling biological material
- Never eat, drink, smoke, or apply cosmetics in the work area

### *b- Clothing Guidelines:*

1. Always wear a wrap-around gown or scrub suit, gloves, and a surgical mask when working with infectious agents or infected animals.
2. Wear gloves over gown cuffs.
3. Never wear contact lenses around infectious agents.
4. Do not wear potentially contaminated clothing outside the laboratory area.
5. To remove contaminated clothing, follow these steps:
  - a. Remove boots from the back.
  - b. Remove head covering from the peak.
  - c. Untie gown while wearing gloves.
  - d. Remove gloves by peeling them from the inside out.
  - e. Remove the gown by slipping your finger under the sleeve cuff of the gown.

*c- Handling Procedures:*

- 1- Use mechanical pipetting devices.
- 2- Minimize aerosol production.
- 3- Add disinfectant to water baths for infectious substances.
- 4- Use trunnion cups with screw caps for centrifuging procedures. Inspect the tubes before use.
- 5- Use secondary leak-proof containers when transporting samples, cultures, inoculated Petri dishes and other containers of bio-hazardous materials.

*d- Syringes:*

- 1- Avoid using syringes and needles whenever possible. If a syringe is necessary, minimize your chances of exposure by following these guidelines:
- 2- Use a needle-locking or disposable needle unit.
- 3- Take care not to stick yourself with a used needle.
- 4- Place used syringes into a pan of disinfectant without removing the needles.
- 5- Do not place used syringes in pans containing pipettes or other glassware that require sorting.
- 6- Do not recap used needles.
- 7- Dispose needles in an approved sharps container.

*e- Work Area:*

- 1- Keep laboratory doors shut when experiments are in progress.
- 2- Limit access to laboratory areas when experiments involve bio-hazardous agents.
- 3- Ensure that warning signs are posted on laboratory doors. These signs should include the universal biohazard symbol and the approved biosafety level for the laboratory.
- 4- Ensure that vacuum lines have a suitable filter trap.
- 5- Decontaminate all potentially contaminated equipment and work surfaces daily and after each spill. Completely decontaminate equipment before having maintenance or repair work done.

- 6- Transport contaminated materials in leak-proof containers.
- 7- Keep miscellaneous material (i.e., books, journals, etc.) away from contaminated areas.

*f- Universal Precautions:*

Clinical and diagnostic laboratories often handle specimens without full knowledge of the material's diagnosis; these specimens may contain infectious agents. To minimize exposure, observe universal precautions when handling any biological specimen. Consider all specimens to be infectious and treat these materials as potentially hazardous.

## 5 References

- [1] Safety in the chemical laboratory a Vanderbilt Environmental Health & Safety (VEHS) safety reference manual.
- [2] Chemical and Biological laboratory safety the Environmental Health and Safety Office (EH&S) manual.
- [3] Uta laboratory safety manual in chemical laboratories.
- [4] Occupational Health and Safety Management System auditor training course/ Bureau Veritas quality international.
- [5] University of Chicago Environmental health and safety Feb:2013
- [6] Pandey, A. & Anbu, M., Laboratory Safety Manual: Including Chemical Hazards and Safety Procedures
- [7] Laboratory & Chemical Safety Guide Optical & Semiconductors Devices Group department of electrical & electronics engineering Imperial college ,London 2003
- [8]Health & Safety policies and procedures .chemical engineering and applied chemistry University of Toronto**